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LABORATORY STUDIES OF ATOMIC COLLISION PROCESSES (U)
PITTSBURGH UNIV PA DEPT OF PHYSICS R JOHNSON ET AL.
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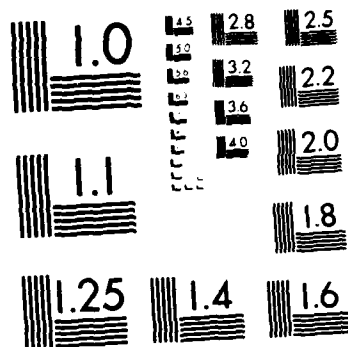
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19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Dissociative recombination, electronics, ions, ion-molecule reactions, ion-ion recombination, high-pressure recombination.		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The various electron and ion collision processes investigated under the ARO grant are enumerated. A list of the journal articles describing the results is given.		

I. Scope of the Research Program

During the grant period, 11/1/83 to 1/31/87, we have carried out experimental investigations of basic atomic collision processes involving ions, electrons and neutrals in gaseous plasmas. Data of this kind are required for such purposes as model calculations of high-power laser plasmas, fast switches and ionized regions of the earth's ionosphere.

Accomplishments during the past report period:

A. Measurements of the electron-ion recombination of complex ions in plasmas at moderate gas pressures (10 to 20 Torr).

1. Dissociative recombination of O_4^+ ions with electrons as a function of electron temperature.
2. Development of computer codes to describe electron-energy gain and loss processes in plasmas heated by microwaves, including effects of inelastic collisions with molecules and spatially non-uniform fields.

B. Studies of atomic collisions in plasmas at high neutral densities

1. Development of the rf-conductivity method to determine electron and ion densities in plasmas at atmospheric neutral densities. Development of mass-spectrometric techniques to analyze the ion composition of plasmas at high neutral densities.
2. Measurements of electron-ion recombination for several ionic species in atmospheric density helium plasmas.
3. Development of computer codes to describe the decay of photo-ionized plasmas in a high-neutral-density environment.
4. Measurements of the pressure dependence of positive ion-negative ion recombination over the range from a few hundred Torr to 2 atmospheres.

C. Studies of ion-molecule reactions

1. Measurements of the temperature dependence of the first and second steps in the clustering reactions of H_2CN^+ ions with HCN.

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II. Publications during the present grant period
(reprints available on request)

1. "RF probe method for measurements of electron densities in plasmas at high neutral densities", R. Johnsen, Rev. Sci. Instr. {57}, 428 (1986)
2. "Recent advances in in high pressure Swarms", R. Johnsen and H.S. Lee, in "Swarm studies and inelastic electron-molecule collisions" (edited by L.C. Pitchford et al., Springer 1987)
3. "Electron temperature dependence of the recombination of electrons with NO^+ ions", J.L. Dulaney, M.A. Biondi, and R. Johnsen", Phys. Rev.A, accepted for publication
4. "Electron temperature dependence of the recombination of O_4^+ ions with electrons", J.L. Dulaney, M.A. Biondi, and R. Johnsen, (to be submitted to Phys. Rev. A)
5. "Clustering reactions of H_2CN^+ ions with HCN ", B.K. Chatterjee and R. Johnsen (to be submitted to J. Chem. Phys.)

III. Participating Scientific Personnel

Faculty: M.A. Biondi
R. Johnsen
Graduate Students: J.L. Dulaney (Ph.D. 1986)
S. Dheandhanoo (Ph.D. 1984)
H.S. Lee
B.K. Chatterjee.

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